

Robots as Future Artificial Inspectors using Biologically Inspired Technologies

Dr. Yoseph Bar-Cohen,
Jet Propulsion Laboratory/Caltech
4800 Oak Grove Drive, M/S 82-105, Pasadena, CA 91109, USA
e-mail: yosi@jpl.nasa.gov Web: <http://ndeaa.jpl.nasa.gov>

ABSTRACT

Imagine an inspector conducting NDE on an aircraft where you notice something weird about him – he is not real but rather he is a robot. Your first reaction would probably be to say “it’s unbelievable but he looks so real” just like your reaction to an artificial flower. This science fiction scenario could become a reality at the trend in the development of biologically inspired technologies that include artificial muscles, artificial intelligence, artificial vision and numerous other related capabilities. For many years, the trend has been to automate processes in order to make redundant tasks more efficient and novel systems were developed to deal with various production line requirements. Realizing that some parts are too complex to handle with a simple automatic system led to the development of robotic mechanisms that can manipulate parts and perform complex and delicate tasks while learning new capabilities as the processes evolve. Aircraft inspection has benefited from this evolving technology where manipulators and crawlers were developed to allow rapid and reliable inspection. One of the limiting factors in wide use of robotics for inspection of aircraft and other complex structures is the small number of parts that are involved that make such an application uneconomical. Autonomous robots, which may look like human, can potentially address this need for robots that are capability of inspect structures with varying configurations. Such operation may take place at harsh or hazardous which are too dangerous for human presence. The capability to make such robots is becoming increasingly feasible and in this presentation the state of the art will be reviewed.

BIOGRAPHY

Dr. Yoseph Bar-Cohen is a physicist specialized in ultrasonic NDE and electroactive materials and mechanism. He is a Senior Research Scientist, Group Leader and the Resident NDE Expert at the Jet Propulsion Laboratory (JPL) responsible for the NDE and Advance Actuators (NDEAA) Technologies (<http://ndeaa.jpl.nasa.gov/>). Dr. Bar-Cohen is also an Adjunct Professor at the University of California, Los Angeles (UCLA) and an ASNT Fellow. Two notable discoveries of Dr. Bar-Cohen are the leaky Lamb waves (LLW) and polar backscattering phenomena in composite materials. He received his Ph. D. in Physics (1979) and M.Sc. in Materials Science (1973) from the Hebrew University, Jerusalem, Israel. In 1991, he established the JPL’s NDEAA Lab that led to a series of innovative concepts and mechanisms, including an ultrasonic drill that is being considered for planetary exploration missions. Currently, he is responsible for developing electroactive polymer actuators, ultrasonic drill, piezoelectric motors, piezoelectric pump, ultrasonic NDE methods, real time sensing, geophysical probing techniques, haptic interfaces, and high power ultrasonic techniques. His scientific and engineering accomplishments have earned him the 2001 NASA Honor Award: NASA Exceptional Engineering Achievement Medal, and the 2001 SPIE’s NDE Life Time Achievement Award.